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# Pesticide Fact Sheet Number 117
# Methyl Parathion

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This document contains up-to-date chemical information, including a summary of the Agency's regulatory position and rationale, on a specific pesticide or group of pesticides. A Fact Sheet is issued after one of the following actions has occurred.

1. Issuance or reissuance of a registration standard,
2. Issuance of each special review document,
3. Regis'..ation of a significantly changed use pattern,
4. Registration of a new chemical, or
5. An immediate need for information to resolve controversial issues relating to a specific chemical or use pattern.

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b. Identifiers/Open-Ended Terms

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EPA

# Pesticide Fact Sheet

Name of Chemical: METHYL PARATHION
Reason for Issuance: ISSUANCE OF GUIDANCE DOCUMENT
Date Issued: December 1986
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1. DESCRIPTION OF CHEMICAL

Generic Name: 0,0-dimethyl-0-4-nitrophenyl phosphorothioate

Common Name: Methyl Parathion

Trade Names and other names: 0,0-dimethyl 0-(4-nitrophenyl) phosphorothioate; 0,0-dimethyl 0-(p-nitrophenyl) phosphorothioate; parathion-methyl; metaphos; Cekumethion; Devithion; dimethyl parathion; E601; Folidol M; Fosferno M50; Parataf; Paratox; Partron M; Penncap M; Tekwaisa; Wofatox; Metacide; Bladan M; Metron; Dalf; Nitrox 80.

EPA Shaughnessy Code: 053501

Chemical Abstracts Service (CAS) Number: 298-00-0

Year of Initial Registration: 1954

Pesticide Type: Insecticide

Chemical Family: Organophosphate

U.S. and Foreign Producers: Monsanto in the U.S., and Bayer, AG in West Germany, Chemiekombinat Bitterfield VEB in East Germany, and A/S Cheminova in Denmark.

2. USE PATTERNS AND FORMULATIONS

Application Sites: Field, vegetable, tree fruit and nut crops, tobacco and ornamentals, forestry, aquatic food crops, mosquito abatement districts, terrestrial and non-crop sites.

Pests controlled: A wide variety of insects and mites as well as tadpole shrimp.

Types and methods of application: Usual appication is foliar. May be applied by aircraft or ground equipment.

Types of Formulations: Dusts, wettable powders, micro-encapsulated, emulsifiable concentrates, and ready-to-use liquid.

Rates: 0.1 to 6.0 lbs. a.i. per acre

Usual Carriers: petroleum solvents, clay carriers

3. SCIENCE FINDINGS

Summary Science Statement:

Methyl parathion is a Toxicity Category I organophosphate compound which is highly toxic to laboratory mammals, humans, aquatic invertebrates, and birds. There is some evidence that methyl parathion may effect reproductive success in birds. Methyl parathion poses a hazard to many endangered species. In laboratory rats of the Wistar strain, oncogenicity could not be determined as the data were insufficient; the Agency is requiring additional information on this study as well as a repeat of the mouse study. Chronic toxicity data indicate that methyl parathion causes retinal and sciatic nerve damage in rats at high dose levels (50 ppm in diet). Because data are not available, the Agency is unable to determine a no observed effect level (NOEL) for sciatic nerve damage.

Chemical characteristics:

Little information is available. Technical methyl parathion has a vapor pressure of 0.14 $mg/m^3$ at 20 C, and an octanol/water parition coefficient of 3300. Methyl parathion is soluble in most organic solvents and is slightly soluble in aliphatic hydrocarbons. This compound is practically insoluble in water.

Toxicology Characteristics:

Acute Toxicity:

Methyl parathion causes cholinesterase inhibition. It is highly toxic to mammals by all routes of exposure and is classified in Toxicity Category I ($LD_{50}$ 4.5 to 16 mg/kg).

Major Routes of Exposure:

The major route of exposure is acknowledged to be dermal with inhalation, ocular, and oral exposure being much smaller.

Information from the California Department of Food and Agriculture reported incidents of worker poisonings and illnesses during mixing, loading and application of methyl parathion. EPA is requiring additional "Worker Safety Rules," including protective clothing, to reduce exposure.

Delayed Neurotoxicity:

Methyl parathion is not believed to cause delayed neurotoxicity.

Chronic feeding/Oncogenicity studies:

The Agency has two 2 year chronic feeding/oncogenicity studies in the rat, one in the mouse and a one-year dog study.

The Agency is unable to definitively evaluate oncogenicity at this time; additional information is required in the Wistar rat strain and another mouse study is required. Chronic effects noted; retinal and sciatic nerve damage at high dose levels(50 ppm) was observed in the rat.

Subchronic Studies:

Subchronic feeding studies show cholinesterase as the primary target for the toxic action of methyl parathion. A NOEL was estabiched in the rat at 2.5 ppm or 0.25 mg/kg/day. The NOEL in the dog was 0.3 mg/kg/day (this NOEL was used to establish the current PADI). However, additional subchronic studies in both the rat and dog are required to determine the NOEL for retinal and sciatic nerve damage in the rat and retinal damage in the dog.

Metabolism:

Data gap; additional data are required.

Teratogenicity:

Some evidence of embryotoxicity and fetotoxicity at 1.0 mg/kg in rats. However, maternal toxicity was not established. Additional data are required. No signs of developmental toxicity were noted in the rabbit.

Reproduction:

No reproductive effects were observed in rats at dietary levels up to 25 ppm. No additional information is required.

Mutagenicity:

The Agency has evaluated the reports of a number of assays which address the three major categories of alterations, i.e., 1)gene mutation, 2), structural chromosomal aberrations, and 3) other mechanisms of genotoxicity. Although results of several of the individual tests are negative, other tests in each of these major categories provide limited evidence that methyl parathion is genotoxic. No additional information is required.

Physiological and Biochemical Characteristics:

Methyl parathion acts by causing irreversible inhibition

of cholinesterase enzyme, allowing accumulation of acetylcholine at cholinergic neuroeffector junctions and autonomic ganglia. Poisoning symptoms include headaches, nausea, vomiting, cramps, weakness, blurred vision, pinpoint pupils, tightness in the chest, drooling or frothingtof mouth and nose, muscle spasms, coma, and death. The mechanism of pesticidal action is not known.

Environmental Fate and Exposure:

Insufficient information is available for the analysis of the environmental fate and the exposure of humans and nontarget organisms to methyl parathion. Additional data are required.

Methyl parathion, it is believed, does not bioaccumulate.

Dermal, ocular, and inhalation exposure can occur during mixing, loading, and application, cleaning and repair of equipment, and during early reentry. EPA is requiring additional "Worker Safety Rules," including protective clothing, to reduce exposure.

Methyl Parathion, it is believed, has little or no potential to contaminate ground water. This chemical was not included on the list of potential ground water contaminators.

Ecological Characteristics:

Avian Oral Toxicity: 6.6 mg/kg for mallard duck and 7.6 mg/kg for bobwhite quail.

Avian Dietary Toxicity: 336 ppm for mallard duck and 90 ppm for bobwhite quail.

Small Mammal Oral Toxicity: 57 to 379 mg/kg for microtine rodents

Avian Reproduction: Laboratory studies showed no direct reproductive impairment; however, significant depression of brain cholinesterase activity was observed (These studies were conducted with the Penncap M formulation.) Field studies indicate the possibility of reproductive impairment. Effects on the survival of nestlings were also noted.

Freshwater Fish Acute Toxicity: 3.7 ppm for rainbow trout and 4.4 ppm for bluegill.

Aquatic Invertebrate Acute Toxicity: <u>Daphnia magna</u> 0.14 ppb

Marine and Estuarine Toxicity: Mysid shrimp 0.98 ppb
Sheepshead minnow 12,000 ppb

Endangered Species:

Previous consultations with the Office of Endangered Species have resulted in jeopardy opinions and labeling for crops (alfalfa, apples, barley, corn, cotton, pears, peanuts, sorghum, soybeans, and wheat), rangeland and pastureland, silvacultural sites, aquatic sites, and noncropland use. Labeling is required in an effort to reduce the risk to endangered species.

Tolerance Assessment:

Present United States, Canadian, Mexican and Codex tolerances for methyl parathion in or on raw agricultural commodities are specified in Table 1. Established tolerances for residues of methyl parathion are also listed in 40 CFR Sections 180.121 (a) and (b). Because there are considerable gaps in both residue chemistry and toxicology, a tolerance assessment cannot be made at this time. The nature of the residue in plants and animals is not adequately understood because of inadequate metabolism data. When the required data are submitted to the Agency, the following will be evaluated: 1. the tolerance definition in plants; 2. the need for and nature of tolerances in or on animal commodities.

Because data gaps prevent the formulation of an acceptable daily intake, a provisional acceptable daily intake has been established. The PADI for methyl parathion is 0.0015 mg/kg/day with a safety factor of 200. This figure will be retained until additional data are received. The theoretical maximum residue contribution for methyl parathion is approximately 800% of the provisional acceptable daily intake.

Reported Pesticide Incidents:

Most of the pesticide incidents reported involve illnesses during mixer/loading, application, and drift from target areas.

4. Summary of Regulatory Position and Rationale

A review of the data available indicates that no risk criteria listed in 40 CFR 154.7 have been met or exceeded for methyl parathion.

The Agency is requiring avian reproduction and terrestrial full field testing and simulated or full field aquatic testing to better define the extent of exposure and hazard to wildlife.

B. No new tolerances or new food uses will be considered until the Agency has received data sufficient to assess existing tolerances for methyl parathion.

C. The Agency is concerned about the potential for human poisonings (cholinesterase inhibition) from the use of

methyl parathion. The Agency will continue to classify for restricted use (due to very high acute toxicity). The Certified applicator must be physically present during mixing, loading, application, equipment repair, and equipment cleaning. Information from the California Department of Food and Agriculture reported incidents of worker poisonings and illnesses during mixing, loading, and application. EPA is requiring more stringent "Worker Safety Rules", including protective clothing, to reduce exposure.

D. A 48 hour re-entry interval, previously established under 40 CFR 170.3 (b)(2) will remain in effect.

E. The Agency has concluded that data are not adequate to determine the oncogenic potential of methyl parathion. and is requiring another mouse study and additional information on the Wistar rat.

F. The Agency is requiring glove permeability and drift studies because of the high acute toxicity of methyl parathion.

G. All manufacturing-use products and end-use products must bear appropriate labeling as specified in 40 CFR 162.10. Additionally, the following information must appear on the labeling:

a. Labeling requirements have been imposed to protect fish and wildlife (including endangered species).
b. Methyl parathion will continue to be classified Restricted Use and the labeling must state the reason, "Due to very high acute toxicity". Certified applicator must be physically present during mixing,loading, application, repair and cleaning of equipment.
c. Effluent containing methyl parathion may not be discharged into lakes, streams, ponds, estuaries, oceans or public waters unless this product is specifically identified in an NPDES permit. Discharge of effluent containing this product is forbidden without prior notice to the sewage treatment plant authority.
d. Protective clothing requirements are mandatory in order to protect applicators, fieldworkers, mixer/loaders, and persons who clean and repair application equipment.
e. During aerial application, human flaggers are strictly prohibited.

6. SUMMARY OF MAJOR DATA GAPS

Animal and plant metabolism studies
Magnitude of residue in almost all crops
Full battery of Environmental Fate data
Additional subchronic toxicity testing to determine a NOEL for cholinesterase inhibition and other systemic effects (retinal degeneration, sciatic nerve effects, abnormal gait)

Additional oncogenicity and teratogenicity information
Glove permeability and drift studies
Aquatic accumulation studies
Avian reproduction and terrestrial full field testing
Simulated or full field aquatic testing
Early life stage and fish life cycle studies
Reentry studies
Applicator Exposure Monitoring studies

7. CONTACT PERSON AT EPA

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DISCLAIMER: The information presented in this Chemical Information Fact Sheet is for informational purposes only and may not be used to fulfill data requirements for pesticide registration and reregistration.

METHYL PARATHION
TABLE I
Summary of Present Tolerances

| Commodity | Tolerances (ppm) United States[a/] | Canada[a/] | Mexico[a/] | (MRL) International (Codex)[b/] |
|---|---|---|---|---|
| Garden Beets | 1.0 | — | — | — |
| Carrots | 1.0 | — | — | — |
| *Parsnips | 1.0 | — | — | 0.7 |
| Potatoes | 0.1 | — | 0.1 | — |
| Radishes | 1.0 | — | 1.0 | — |
| *Rutabagas | 1.0 | — | — | — |
| Sugar Beets | 0.1 | — | — | 0.5 |
| Sweet Potatoes | 0.1 | — | 0.1 | — |
| Turnip | 1.0 | — | — | — |
| *Garlic | 1.0 | — | 1.0 | — |
| Onions | 1.0 | — | 1.0 | — |
| Celery | 1.0 | — | 1.0 | — |
| *Endive | 1.0 | — | — | — |
| Lettuce | 1.0 | — | 1.0 | — |
| *Parsley | 1.0 | — | — | — |
| Spinach | 1.0 | — | 1.0 | — |
| *Swiss Chard | 1.0 | — | — | — |
| Broccoli | 1.0 | — | 1.0 | 0.2 |
| Brussels Sprouts | 1.0 | — | — | 0.2 |
| Cabbage | 1.0 | — | 1.0 | 0.2 |
| Cauliflower | 1.0 | — | — | 0.2 |
| Collards | 1.0 | — | — | 0.2 |
| Kale | 1.0 | — | — | 0.2 |
| Kohlrabi | 1.0 | — | — | 0.2 |
| Mustard Greens | 1.0 | — | — | 0.2 |
| Beans | 1.0 | — | 1.0 | 0.2 |
| *Guar Beans | 0.2 | — | 1.0 | — |
| Peas | 1.0 | 0.7 | 1.0 | 0.7 |
| *Lentils | 1.0 | — | 1.0 | — |
| Soybeans | 0.1 | — | 0.1 | — |
| Eggplant | 1.0 | — | 1.0 | — |
| Peppers | 1.0 | — | 1.0 | — |
| Tomatoes | 1.0 | — | 1.0 | 0.2 |
| Cucumbers | 1.0 | — | 1.0 | 0.2 |
| Melons | 1.0 | — | 1.0 | 0.2 |
| Pumpkins | 1.0 | — | 1.0 | 0.2 |
| Squash | 1.0 | — | 1.0 | — |
| *Summer Squash | 1.0 | — | 1.0 | 0.2 |
| *Citrus Fruits | 1.0 | — | 1.0 | 1.2 |
| Apples | 1.0 | — | 1.0 | — |
| Pears | 1.0 | — | 1.0 | — |
| *Quince | 1.0 | — | — | — |
| Apricots | 1.0 | — | — | 0.2 |
| Cherries | 1.0 | — | — | 0.2 |
| Nectarines | 1.0 | — | — | 0.2 |
| Peaches | 1.0 | — | 1.0 | 0.2 |
| Plums | 1.0 | — | — | 0.2 |
| *Blackberries | 1.0 | — | — | — |
| Blueberries | 1.0 | — | — | 0.2 |

METHYL PARATHION
TABLE I
Summary of Present Tolerances (con't)

| Commodity | Tolerances (ppm) United States[a/] | Canada[a/] | Mexico[a/] | (MRL) International (Codex)[b/] |
|---|---|---|---|---|
| *Boysenberries | 1.0 | — | — | 0.2 |
| *Cranberries | 1.0 | — | — | 0.2 |
| *Currants | 1.0 | — | — | — |
| *Dewberries | 1.0 | — | — | 0.2 |
| Gooseberries | 1.0 | — | — | 0.2 |
| Grapes | 1.0 | — | — | 0.2 |
| *Loganberries | 1.0 | — | — | 0.2 |
| *Raspberries | 1.0 | — | — | 0.2 |
| Strawberries | 1.0 | — | 1.0 | 0.2 |
| *Youngberries | 1.0 | — | — | 0.2 |
| Almonds | 0.1 | — | — | — |
| *Filberts | 0.1 | — | — | — |
| Pecans | 0.1 | — | — | — |
| *Walnuts | 0.1 | — | — | — |
| Barley | 1.0 | — | — | — |
| Corn | 1.0 | — | 1.0 | — |
| Oats | 1.0 | — | — | — |
| Rice | 1.0 | — | 1.0 | — |
| Rye | 0.5 | — | — | — |
| Sorghum | 0.1 | — | 0.1 | — |
| Wheat | 1.0 | — | — | — |
| Forage Grass | 1.0 | — | — | — |
| Alfalfa Forage | 1.25 | — | 1.25 | — |
| Alfalfa Hay | 5.0 | — | 5.00 | — |
| Clover Forage & Hay | 1.0 | — | — | — |
| *Trefoil | 1.25 | — | — | — |
| *Trefoil Hay | 5.0 | — | — | — |
| Vetch Forage & Hay | 1.0 | — | — | — |
| **Miscellaneous Crops** | | | | |
| Artichokes | 1.0 | — | 1.0 | — |
| Avocados | 1.0 | — | 1.0 | 0.2 |
| Cottonseed | 0.75 | — | 0.75 | — |
| *Dates | 1.0 | — | — | 0.2 |
| *Figs | 1.0 | — | 1.0 | 0.2 |
| *Guavas | 1.0 | — | 1.0 | 0.2 |
| Hops | 1.0 | — | — | 0.05 |
| *Mangos | 1.0 | — | 1.0 | 0.2 |
| Mustard Seed | 0.2 | — | — | — |
| *Okra | 1.0 | — | 1.0 | — |
| *Olives | 1.0 | — | — | 0.2 |
| Peanuts | 1.0 | — | 1.0 | — |
| *Pineapple | 1.0 | — | 1.0 | 0.2 |
| *Rape Seed | 0.2 | — | — | — |
| *Sugarcane | 0.1 | — | 0.1 | — |
| Sunflower Seed | 0.2 | — | — | — |

a = The U.S., Canadian, and Mexican tolerances expressed in terms of residues of methyl parathion per se. b = The Codex Maximum Residue Levels expressed as residues of methyl parathion and its oxygen analog, methyl paraoxon. * These commodities have tolerances but no Federal Registrations.